MODELING of HYDRAULIC FRACTURING on the BASIS of the PARTICLE METHOD

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© Published under licence by IOP Publishing Ltd. A technique of calculating the deformation of the soil environment when it interacts with a liquid on the basis of the particle method a is realized. To describe the behavior of the solid and liquid phases of the soil, a classical two-parameter Lennard-Jones interaction potential and its modified version proposed by the authors were chosen. The model problem of deformation and partial destruction of a soil massif under strong pressure from the liquid pumped into it is solved. Analysis of the results shows that the use of the modified Lennard-Jones potential for describing the solid phase of the soil environment makes it possible to describe the process of formation of cracks in the soil during hydraulic fracturing of the formation.

http://dx.doi.org/10.1088/1755-1315/107/1/012096

References

[1] Badriev I B, Makarov M V and Paimushin V N 2016 Procedia Engineering 150 55
[2] Badriev I B, Makarov M V and Paimushin V N 2016 Procedia Engineering 150 62
[3] Shigapova F A, Mustakimova R F, Saleeva G T and Sachenkov O A 2015 International Journal of Applied Engineering Research 10 44711-14
[4] Sachenkov O A, Mitryaikin V I, Zaitseva T A and Konoplev Yu G 2014 Applied Mathematical Sciences 8 7889-7897
[5] Sultanov L U 2015 Procedia Earth and Planetary Science 15 24
[6] Golovanov A I and Sultanov L U 2005 International Applied Mechanics 41 614-20
[7] Sultanov L U 2014 Applied Mathematical Sciences 8 7117-24
[8] Zienkiewicz O 1977 The finite element method (Mc Graw-Hill) 787
[9] Wilkins M L 1967 Vychislitelnye metody v gidrodinamice (Mir) 212-63
[10] Evans M W and Harlow F H 1957 Los Alamos Scientific Laboratory Report No. LA-2139 (Los Alamos)
[11] Berezhnoi D V, Balafendieva I S, Sachenkov A A and Sekaeva L R 2016 IOP Conference Series: Materials Science and Engineering 158 012018
[12] Mokshin E V and Berezhnoi D V 2016 IOP Conference Series: Materials Science and Engineering 158 012069
[13] Hockney R W and Eastwood J W 1981 Computer simulation using particles (McGraw-Hill)
[14] Grigorjev Yu N and Vshivkov V A 2000 Numerical methods "particle-in-cell" (Nauka)
[15] Bogomolov S V, Zamaraeva A A, Karabelly H and Kuznetsov K V 1998 Computational Mathematics and Mathematical Physics 38 1602
[16] Monaghan J J 2005 Reports on Progress in Physics 68 1703-59
[17] Krivtsov A M and Krivtsova N V 2002 Far Eastern Mathematical Journal 3 254-76
[18] Psahje S G, Smolin A Yu, Stefanov Yu P, Makarov P V and Chertov M A 2004 Letters Technical Physics 30 7-13
[19] Zheltov Y P and Hristianovich S A 1955 Izvestia AN USSR 5 41
[20] Perkins T K and Kern L R 1961 J. Petrol. Technol. 9 49

[21] Maxwell S C, Rutledge J, Jones R and Fehler M 2010 Geophysics 75 75A129-75A137

[22] Duncan P and Eisner L 2010 Geophysics 75 75A139-75A146

[23] Zhao Qi, Lisjak VitaeAndrea, Mahabadi Omid, Liu Qinya and Grasselli Giovanni 2014 Journal of Rock Mechanics and Geotechnical Engineering 6 574-81

[24] Soong C Y, Yen T H and Tzeng P Y 2007 Phys. Rev. E. 76 036303

[25] Galimov M R and Birjaltsev E V 2010 Numerical methods and programming 11 93

[26] Demidov D VexCL: a C++ vector expression template library for OpenCL/CUDA https://github.com/ddemidov/vexcl Acessed 01.09.2017 - ref-separator -

[27] Demidov D, Karsten A, Rupp K and Gottschling P 2013 SIAM Journal on Scientific Computing 35 453-72

[28] Karsten A, Demidov D and Mulansky M 2014 Numerical Computations with GPUs (Springer International Publishing) 125-57

[29] Berezhnoy D V, Gabsalikova N F and Balafendieva I S 2015 International Journal of Applied Engineering Research 10 44677-81

[30] Berezhnoi D V, Gabsalikova N F and Miheev V V 2016 IOP Conference Series: Materials Science and Engineering 158 012016

[31] Berezhnoi D V, Gabsalikova N F, Izotov V G and Miheev V V 2017 IOP Conference Series: Materials Science and Engineering 204 012028